NASA Innovative Advanced Concepts

Robust Optimal Fragmentation and Dispersion of Near-Earth Objects

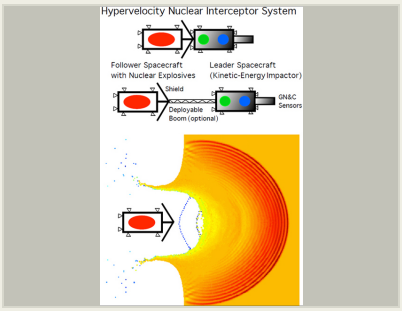
Completed Technology Project (2011 - 2012)

Project Introduction

During the past 2 decades, various concepts for mitigating the impact threats from NEOs have been proposed, but many of these concepts were impractical and not technically credible. In particular, all non-nuclear techniques require mission lead times larger than 10 years. However, for the most probable impact threat with a warning time less than 10 years, the use of high-energy nuclear explosives in space becomes inevitable for proper fragmentation and dispersion of an NEO in a collision course with Earth. However, the existing nuclear subsurface penetrator technology limits the impact velocity to less than 300m/s because higher impact velocities destroy prematurely the detonation electronic equipment. Thus, an innovative space system architecture utilizing high-energy nuclear explosives must be developed for a worst-case intercept mission resulting in relative closing velocities as high as 5-30km/s. An advanced system concept is proposed for nuclear subsurface explosion missions. The concept blends a hypervelocity kinetic-energy impactor with nuclear subsurface explosion, and exploits a 2-body space vehicle consisting of a fore body and an aft body. These 2 spacecraft bodies may be connected by a deployable boom. The fore body provides proper kinetic impact crater conditions for an aft body carrying nuclear explosives to make a deeper penetration into an asteroid body. For such a complex mission architecture design study, non-traditional, multidisciplinary research efforts in the areas of hypervelocity impact dynamics, nuclear explosion modeling, high-temperature thermal shielding, shock-resistant electronic systems, and advanced space system technologies are required. Expanding upon the current research activities, the Iowa State Asteroid Deflection Research Center will develop an innovative, advanced space system architecture that provides the planetary defense capabilities needed to enable a future real space mission more efficient, affordable, and reliable.

Anticipated Benefits

Expanding upon the current research activities of the Iowa State Asteroid Deflection Research Center, funded by the NASA Iowa Space Grant Consortium, the ADRC will develop an innovative, advanced space system architecture that provides the planetary defense capabilities needed to enable a future real space mission more efficient, affordable, and reliable.



Project Image Robust Optimal Fragmentation and Dispersion of Near-Earth Objects

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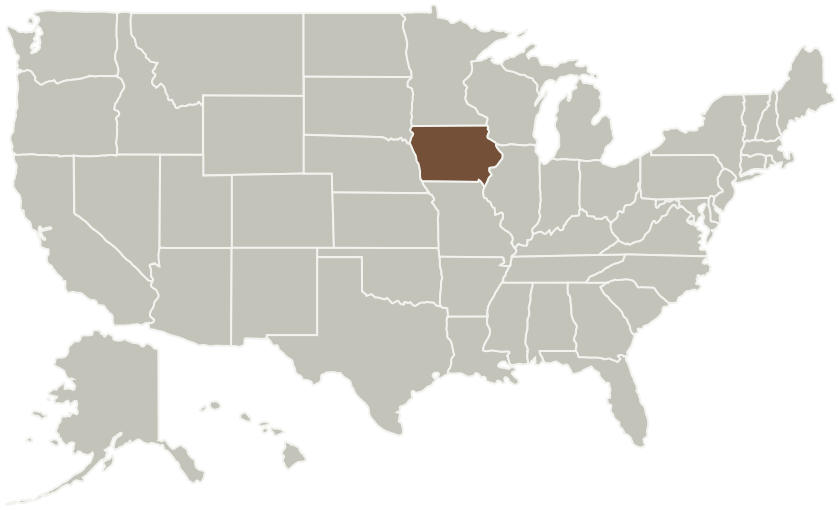
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Iowa State University	Lead Organization	Academia	Ames, Iowa

Primary U.S. Work Locations
Iowa

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Iowa State University

Responsible Program:

NASA Innovative Advanced Concepts

Project Management

Program Director:

Jason E Derleth

Program Manager:

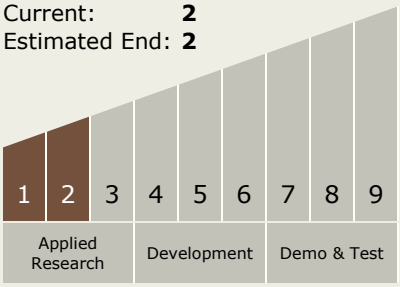
Eric A Eberly

Principal Investigator:

Bong Wie

Technology Maturity (TRL)

Start: **1**
Current: **2**
Estimated End: **2**



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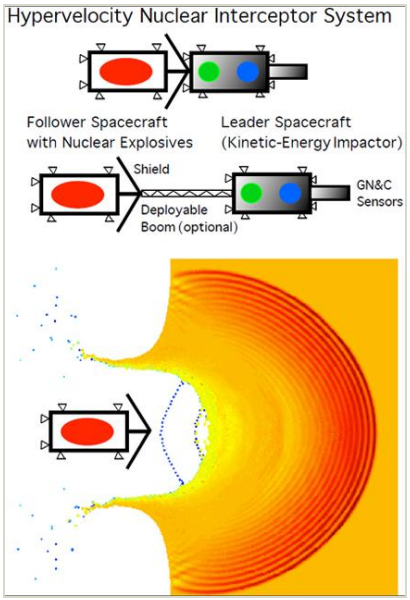
Images



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Project Image Robust Optimal Fragmentation and Dispersion of Near-Earth Objects
(https://techport.nasa.gov/image/102065)

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.1 Power Generation and Energy Conversion
    - TX03.1.6 Other Advanced Concepts for Generating/Converting Power

Target Destinations

Others Inside the Solar System, Foundational Knowledge